

ORAL PRESENTATION

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Left atrial spherical shape change in atrial fibrillation

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Background

Atrial fibrillation (AF) is associated with increase in size of the left atrium (LA). Recent studies have shown that LA shape may be an earlier and independent marker of atrial remodeling in AF. However, previous studies have been limited to qualitative assessments of shape and parameters that do not fully characterize shape. In this study, we use an entropy-driven particle-based shape modeling technique to investigate the relationship between shape and volume of the LA in AF.

Methods

The Utah AF database was queried for patients who underwent MRI of the LA with paroxysmal AF (n = 50), persistent AF (n = 50), and no arrhythmia (n = 37). The LA walls were segmented manually using Corview (Markrek[®]) software. LA volume was calculated from the segmented slices. The ostia of the pulmonary veins were excluded prior to shape modeling. Based on the method described by Cates et al., a set of 1024 corresponding surface points were mapped onto each LA surface. Principle component analysis (PCA) was conducted to generate 137 parameters (PCA modes). Shape change was observed with respect to the first parameter, and empirically showed increasing spherical shape of the LA. Therefore, this parameter was defined as the “spherical parameter”. ANOVA was performed to compare volume and the spherical parameter between control, paroxysmal and persistent groups. Linear regression was used to correlate volume with the spherical parameter in the entire cohort and in each group.

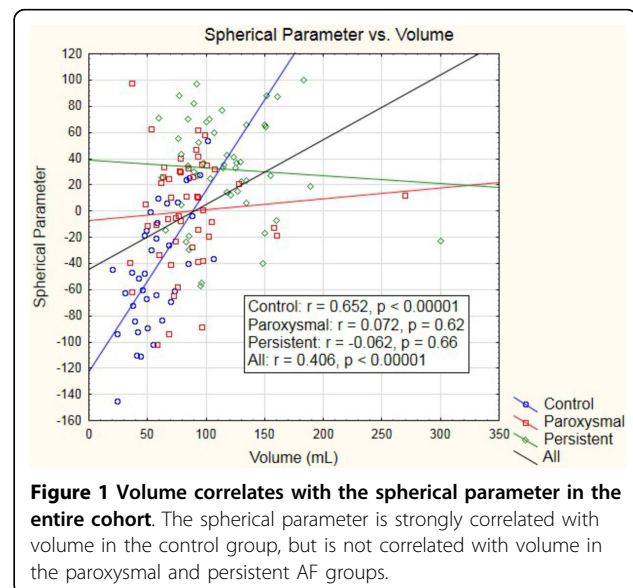
Results

LA volume was significantly increased in paroxysmals (85.1 mL) relative to controls (57.3 mL), persistents

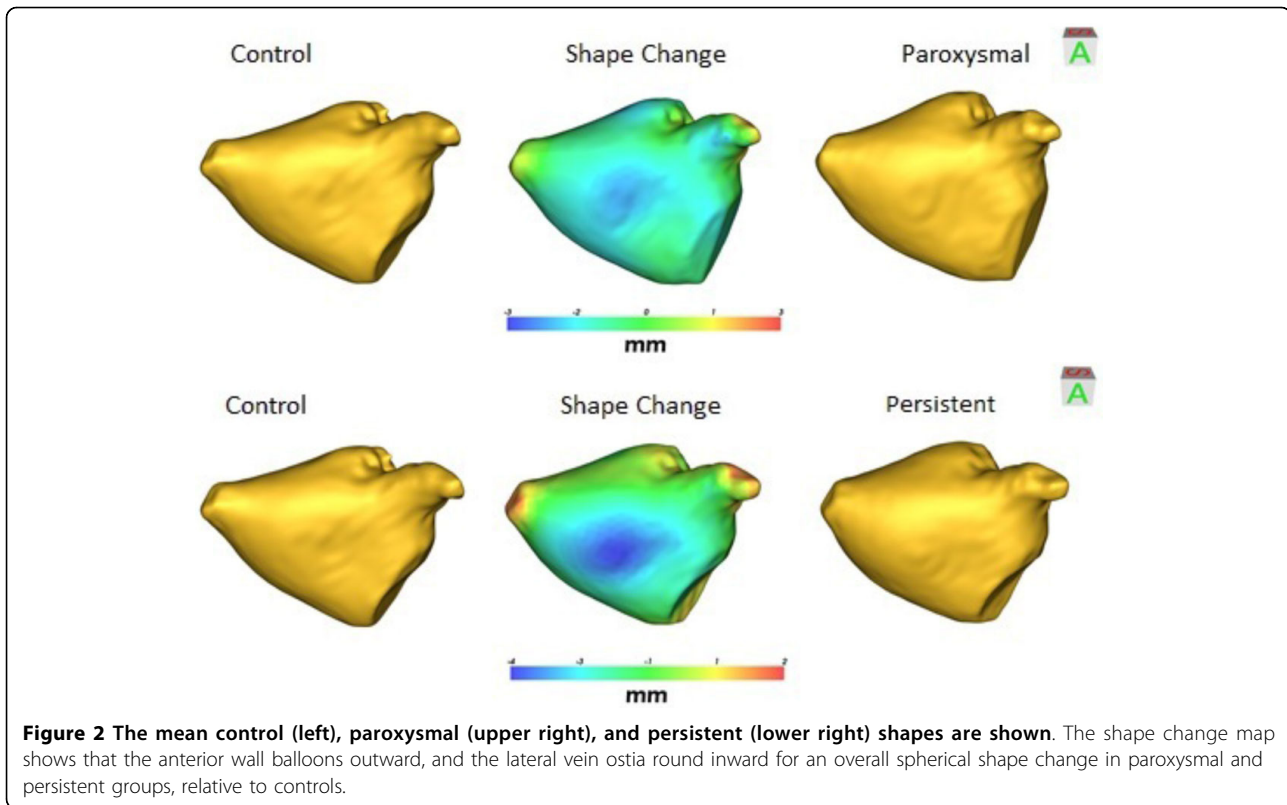
(116.9 mL) to controls, and persistents to paroxysmals (all $p < 1 \times 10^{-3}$). The spherical parameter was significantly increased in paroxysmals relative to controls, persistents to controls, and persistents to paroxysmals (all $p < 1 \times 10^{-3}$). Linear regression showed significant correlation of volume with the spherical parameter in the entire cohort ($p < 1 \times 10^{-4}$) and in the control group ($p < 1 \times 10^{-4}$), but no correlation in the paroxysmal and persistent AF groups (Figure 1).

Conclusions

In this study, we demonstrated that in AF, remodeling of the LA leads to both increased volume and spherical shape change. In non-AF patients, spherical shape change and volume expansion occur together. However in AF patients, spherical shape change occurs independently of volume expansion. Therefore spherical change



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of the LA, quantified by particle-based shape modeling, may be a useful, unique marker of remodeling in AF.

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